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National Oceanic and Atmospheric Administration

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CRUISE RESULTS
NOAA RV MILLER FREEMAN
Cruise No. 90-08

1990 Triennial Trawl Survey in the Eastern Gulf of Alaska

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CRUISE PERIOD, AREA, AND SCHEDULE

From 14 July to 4 September, 1990, the Auke Bay Laboratory (ABL) of the Alaska Fisheries Science Center (AFSC) conducted a bottom trawl survey of groundfish resources in the eastern Gulf of Alaska. The NOAA R/V Miller Freeman was used to trawl waters of the continental shelf and upper continental slope from the U.S./Canada boundary in Dixon Entrance to near Cape St. Elias, west of Yakutat, Alaska. The 1990 survey was the third triennial trawl survey in this region; previously, triennial surveys were conducted here in 1984 and 1987. In 1990, a similar survey of Gulf of Alaska waters west of Cape St. Elias was conducted by the AFSC Resource Assessment and Conservation Engineering Division (RACE). Results of this latter survey will be presented in a separate report.

Date	Activity
14 July	Departed Pacific Marine Center, Seattle, WA; started Leg I.
15-16 July	In transit to southeastern Alaska.
17-23 July	Completed 29 hauls in southeastern Alaska from Dixon Entrance north to Cape Addington.
24-25 July.	Mechanical problems; vessel travelled to Sitka, AK, for repairs.
26-29 July	Completed 22 hauls between Sitka and Cape Addington, including 12 hauls in a rockfish study area off Cape Ommaney.
30 July	Arrived Sitka, AK; ended Leg I.

31 July	Departed Sitka, AK; started Leg II.
1-16 August	Completed 76 hauls between Cape Addington and Yakutat Bay.
17 August	Arrived Sitka, AK; ended Leg II.
18 August	In port, Sitka, AK.
19 August	Departed Sitka, AK; started Leg III.
20 Aug-2 Sept	Completed 76 hauls between Yakutat Bay and Cape St. Elias, including 13 hauls in a rockfish study area off Yakutat.
2 September	Touch and go at Yakutat, AK, to disembark 3 scientists.
3 September	In transit to Kodiak, AK.
4 September	Arrived Kodiak, AK; ended Leg III.

OBJECTIVES

1. Determine the distribution, abundance, and size composition of major groundfish species inhabiting outside waters of the eastern Gulf of Alaska.

2. Collect otoliths from selected species to determine age composition of the stocks.

3. Intensively sample two small rockfish study areas to examine the feasibility of establishing rockfish indexing sites.

4. Collect detailed topographic data at the two rockfish study areas to allow comparison of rockfish abundance with underwater topographic features.

VESSEL AND GEAR

The RV MILLER FREEMAN was a 65.5 m (215 ft) stern trawler equipped with modern trawling and navigational systems. The vessel's main engine was rated at 2,150 horsepower.

A high opening, polyethylene Nor'eastern trawl was used for all fishing operations. This net was originally tested during the 1984 triennial in the Gulf of Alaska, and was selected as the most appropriate standard for a multi-species bottom trawl survey in this region. The net was constructed of polyethylene webbing with four seams, and measured 27.2 m (89.1 ft) along the headrope

and 24.9 m (81.6 ft) along the footrope. The net's mesh measured 12.7 cm (5 in) stretched, with a nylon codend liner whose mesh measured 3.8 cm (1.5 in) stretched. Triple dandylines, 54.9 m (180 ft) long, connected the net to a pair of steel "V" doors measuring 1.8 m by 2.7 m (6 ft by 9 ft) and weighing 998 kg (2200 lb) each. Rubber bobbin roller gear was attached to the footrope of the net to facilitate towing over rough bottoms.

METHODS

Survey Design

The survey design was similar to that used in the 1987 triennial trawl survey in the eastern Gulf of Alaska. The area of the survey extended from the U.S.-Canada boundary in Dixon Entrance to the 144°30' line of longitude near Cape St. Elias (Figure 1). This area encompassed most of the Yakutat INPFC[1] area and all of the Southeastern INPFC area. Only outside waters of the Gulf of Alaska were sampled in the survey; no stations were located in bays or inside passages. The 1987 survey covered depths of 0 to 700 m, but in 1990, coverage was limited to depths < 500 m. This reduction in coverage was necessary because of the reduced vessel days available for the survey in 1990, and also because the 1987 survey had shown that most of the 501-700 m depth stratum in the eastern Gulf of Alaska was untrawlable.

The survey area was divided into 15 subareas by depth and topography, and a planned total of 201 trawl stations was allocated among the subareas (Table 1). This total was based on the ~40 fishing days available for the survey and on an expected completion rate of 5 stations per day. Number of stations allocated to each subarea was based on the allocation scheme used in the 1987 eastern Gulf of Alaska triennial survey, with some modifications: station density in Yakutat subareas in the 101-200 m stratum was reduced by 50%, whereas station density in all subareas > 200 m (both Yakutat and Southeastern) was doubled. This change in the allocation of stations in 1990 was made so that more stations were located in deeper depths, where most of the commercially important species in the eastern Gulf (especially rockfish) are found. No stations were allocated to the Southeastern Shallows subarea because this subarea was found to be almost completely untrawlable in 1987.

Locations of the planned stations in each subarea were randomly determined. For shelf and gully subareas, the survey area was divided into a grid of squares measuring 5 nm on each side (25 nm^2). The stations to be sampled in each of these subareas were

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[1] International North Pacific Fishery Commission statistical area.

then selected from this grid using a random number table. The actual geographic coordinates of a station were at the point in the center of the grid square.

A slightly different approach was necessary to select station locations in slope subareas. The grid technique could not be used because these subareas are relatively small in size and are extremely narrow and elongate in shape. Instead, for each slope subarea, transect lines were drawn such that the area between transect lines was 25 nm^2. Thus, the slope subareas were composed of a number of irregularly shaped segments analogous to the grid squares on the shelf and gullies. The slope stations to be sampled were then selected randomly from these segments. The specific coordinates of a slope station were at the midpoint between the two transect lines bounding each segment.

For each of the 201 randomly located stations, an alternative, non-random station in the same subarea was also determined. These alternative stations were necessary as "backup" stations in case the original planned station proved to be untrawlable. The alternative stations were selected from successful trawl hauls made during 10 previous AFSC survey cruises in the eastern Gulf of Alaska from 1978 to 1987.

Rockfish Study Sites

In addition to the triennial survey, two rockfish study areas were also sampled during Miller Freeman Cruise 90-08. These areas were situated off Cape Ommaney and in Yakutat Valley (Figure 1) in locations where past surveys had found large concentrations of Pacific ocean perch. The Cape Ommaney site was rectangular in shape and measured 4 nm by 6 nm, with a depth range of 187-227 m. The Yakutat Valley site was square and measured 5 nm on each side, with a depth range of 194-218 m.

The reason for fishing these two sites was to investigate the possibility of establishing small rockfish indexing areas as an alternative assessment technique for rockfish. Previously, other indexing sites were established in the Gulf of Alaska in 1981 and 1984 to monitor changes in stock condition of rockfish. These prior sites, however, were large in size (2,000-3,000 nm^2) and covered a range of depths and habitats; consequently, variance of the resultant values of biomass was high. These high variances made it difficult to detect significant changes in biomass, and the indexing approach was dropped in favor of the more comprehensive triennial surveys. Fishing the new study sites at Cape Ommaney and Yakutat Valley was an experiment to determine if smaller sites in localities of relatively uniform depth and habitat would produce rockfish biomasses with lower variances.

Two fishing days were spent at each study site. To determine trawling locations, the sites were subdivided into a grid of

squares measuring 1 nm on each side. Trawl stations were then systematically located in every other square, resulting in 12 stations at the Ommaney site and 13 stations at the Yakutat site. All hauls were 10 minutes in duration to ensure that trawl paths did not extend into adjoining squares.

The topographic studies planned for the study sites (cruise objective #4 listed previously) were not completed. Detailed depth and location data were supposed to have been recorded using the vessel's shipboard computer system during nighttime transects of each study site. No data were collected, however, because of software problems in the computer system.

Fishing and Catch Sampling Methods

Fishing and catch sampling methods were generally similar to those used in previous AFSC trawl surveys. Prior to fishing, each station was surveyed using the Miller Freeman's recording fathometer, and a trawl path was selected. This surveying was usually done at night previous to the day when the station was to be fished. The captain was given the discretion to locate the trawl path anywhere within the station's boundaries (i.e., within the boundaries of the station's grid square). If the fathometer survey indicated the station was untrawlable, the alternative station was substituted, and this alternative station was also surveyed.

Standard duration of survey hauls was 30 minutes, measured from the time the net reached the bottom until the start of haul back. A Furuno net-sounding system was used to monitor the position of the net relative to the bottom. This system allowed a precise determination of when the net touched bottom and also ensured that it remained on bottom for the remainder of the tow. At some stations, because of rough bottom, net hang-ups, or expected large catches of fish, hauls were shorter than 30 minutes. Tows less than 10 minutes long, or where the net was severely ripped, were not considered valid, and results from these tows were not included in the survey's analysis. Towing speed of the Miller Freeman averaged 3.1 knots, and for individual hauls ranged from 2.4 to 3.9 knots.

An acoustic net mensuration system (the "SCANMAR") was used on ~75% of the hauls during the cruise to measure the width and height of the net opening. Width measurements were especially critical to determine the area swept by the trawl, data which are essential for subsequent calculations of catch per unit effort and biomass. Depending upon the haul, average width measurements ranged from 12.29 to 19.97 m, and average height ranged from 5.72 to 9.33 m. The SCANMAR system was not deployed on hauls that were made over rough bottoms to ensure that its units attached to the net were not lost or damaged.

Catches less than ~2,500 lb were processed in their entirety. The catch was sorted, weighed, and counted by species. For abundant or commercially important species, sex was determined and the fish were measured for length frequency distributions. When a species was very abundant in a catch, a random subsample of ~100-200 individuals was taken for the sex determinations and length measurements. For catches > 2,500 lb, a load cell was used to weigh the entire catch, and a 1,000-2,000 lb subsample was retained and processed in the above manner; the unprocessed remainder of the catch was discarded overboard.

In many hauls, selected rockfish and flatfish species were also subsampled for otolith extractions. Generally, for rockfish species in an individual haul, a maximum of 2 fish per cm length per sex were sampled for otoliths. Flatfish otolith collections were on an area basis: a maximum of 2 fish per cm length per sex were sampled in each INPFC area. Scientists from the International Pacific Halibut Commission collected otoliths from all Pacific halibut caught during the cruise.

Bottom water temperature data were collected for each haul using the Furuno net sounder's temperature sensor.

RESULTS

A total of 203 hauls were made during the cruise (Table 2; Figure 1). Of these, 187 were considered to be successful, i.e., valid for analysis. Of the successful hauls, 166 were completed for the triennial survey, and the other 21 hauls were in the rockfish study areas. (Three survey hauls were located inside the rockfish study areas, and these hauls were considered valid for both the survey and the rockfish study; therefore, a total of 24 successful hauls were completed in the study areas.) The 166 successful survey hauls represented a 32% increase in survey effort as compared with the 1987 eastern Gulf of Alaska survey, when only 126 successful hauls were completed. The increased number of hauls in 1990 was due to the generally good weather conditions during the cruise, combined with the Miller Freeman's ability to operate in worse weather than could the smaller charter vessels used in the 1987 survey.

Of the planned, randomly located survey stations, 180 were visited (Table 1). The 21 remaining planned stations were skipped; most of these were in the beginning of the cruise in the Southeastern area, when there was some initial concern the cruise might fall behind schedule.

Most of the survey region in the Yakutat area was trawlable, but much of the Southeastern area was not (Table 1). Overall, 79% of the visited stations in Yakutat were categorized as "trawlable", whereas trawlable stations in Southeastern totaled only 57%.

This difference in trawlability between the two areas was actually greater than these two percentages indicate, because the largely untrawlable Southeastern Shallows subarea (0-100 m stratum) was omitted from the survey design in 1990. The only subarea in Southeastern with a high percentage of trawlable stations was the Baranof-Chichagof Slope; in contrast, nearly all the Yakutat subareas had a high percentage of trawlable stations. In both Yakutat and Southeastern, the 301-500 m slope appeared to be especially untrawlable, and this indicates that this stratum was very poorly sampled in the survey.

Summaries of the fish measured in the survey for length frequency distributions and summaries of the otolith samples collected are listed in Tables 3 and 4, respectively.

Pacific ocean perch was the predominate species caught in both the Yakutat and Southeastern areas (Tables 5 and 6). In both areas, arrowtooth flounder was by far the most abundant flatfish, followed by Dover sole. Sharpchin and redstripe rockfish had high CPUE's in the Southeastern area, but were caught in only small amounts in Yakutat. In general, the Southeastern area appeared to be more productive for most species than was Yakutat. Compared to the 1987 survey, CPUE of harlequin and dusky rockfish showed a sharp decline. Abundance of Pacific halibut also appeared to be less in 1990.

The distribution of rockfish catches at the two rockfish study areas were very different when compared with each other (Table 7). Catches of Pacific ocean perch at the Yakutat Valley site were highly variable between hauls, whereas those at the Cape Ommaney site were much more consistent. Catches of dusky and sharpchin rockfish at Yakutat Valley were also quite variable. These data indicate that rockfish were distributed relatively evenly at the Cape Ommaney site, but appeared to be aggregated in localized areas at Yakutat Valley.

Confidence intervals of the estimated biomass at each area reflect this apparent difference in distribution (Table 8). Although the biomass estimates for Pacific ocean perch at each site were similar, the associated confidence interval at the Yakutat Valley site was ~ three times as large as the corresponding interval for Cape Ommaney. The wide confidence intervals at Yakutat Valley suggest that, if this area was used as a rockfish index site, it likely would be difficult to detect significant changes in abundance between surveys. The lower confidence intervals at Cape Ommaney indicate that this area holds more promise as a possible rockfish index site. Clearly, more research into the localized distribution of rockfish is needed to determine whether the indexing technique is appropriate.

More detailed analyses of the survey results will be completed at a later date, when the results of this cruise are combined with those from the RACE Division's survey of the central and western Gulf of Alaska. These analyses will include area-swept estimates of CPUE and biomass for all important species, by depth, and will also include comparisons with the previous triennial surveys in 1984 and 1987. A fishing log for Miller Freeman Cruise 90-08, with positions and detailed catch records for each haul, is also being prepared. This log will be available from the Auke Bay Laboratory in mid-1991.

SCIENTIFIC PERSONNEL

Name	Position	Organization
Leg I: 14-30 July		
David Clausen	Chief Scientist	ABL
Kenneth Krieger	Fishery Biologist	ABL
Daniel Ito	Fishery Biologist	REFM
Julie Pearce	Biological Technician	REFM
Morris Wade	Biological Technician	IPHC
Leg II: 31 July-17 August		
Richard Haight	Chief Scientist	ABL
Ellen Varosi	Fishery Biologist	ABL
James Lynk	Computer Specialist	ABL
Daniel Kamikawa	Fishery Biologist	ABL
Morris Wade	Biological Technician	IPHC
Leg III: 19 August-4 September		
Thomas Rutecki	Chief Scientist	ABL
Nancy Maloney	Fishery Biologist	ABL
Chris Derrah	Fishery Biologist	ABL
Daniel Kamikawa	Fishery Biologist	ABL
Bernard Vienneau	Programmer/Biologist	IPHC

ABL= NMFS Auke Bay Laboratory, Auke Bay, Alaska.
REFM= NMFS Resource Ecology and Fishery Management Division, Seattle, Washington.
IPHC= International Pacific Halibut Commission, Seattle, Washington.

For more information concerning Miller Freeman Cruise 90-08, contact:

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Table 1.—Summary of planned survey stations and those actually visited during Miller Freeman Cruise 90-08, 1990 triennial trawl survey in the eastern Gulf of Alaska. Visited stations are broken into three categories: trawlable, marginally trawlable, and untrawlable. (Data in table include randomly located stations only.)

Depth stratum (m)	Subarea	Number of stations				
		planned	visited	trawlable	marginally trawlable	un-trawlable
		Yakutat[a] Area:				
0–100	Yakutat Shallows	6	6	5	0	1
101–200	Yakataga Shelf	9	9	8	1	0
101–200	Yakutat Flats	15	15	10	4	1
101–200	Fairweather Shelf	13	13	11	2	0
201–300	Yakutat Gullies	20	19	19	0	0
201–300	Yakutat Slope	12	8	5	2	1
301–500	Yakutat Deep Gullies	12	11	11	0	0
301–500	Yakutat Slope	10	10	3	1	6
	Total, Yakutat	97	91	72	10	9
		Southeastern[b] Area:				
0–100	Southeastern Shallows	0	–	–	–	–
101–200	Baranof-Chichagof Shelf	15	13	8	1	4
101–200	Prince of Wales Shelf	21	18	8	5	5
201–300	Baranof-Chichagof Slope	10	9	7	2	0
201–300	Prince of Wales Slope and Gullies	30	24	17	1	6
301–500	Southeastern Deep Gullies	20	18	11	5	2
301–500	Southeastern Slope	8	7	0	2	5
	Total, Southeastern	104	89	51	16	22
Grand Total for survey		201	180	123	26	31

[a]Yakutat INPFC area east of 144°30′ longitude.

[b]Southeastern INPFC area.

trawlable stations: stations successfully towed with no problems encountered.

marginally trawlable stations: stations successfully towed, but where, because of steep topography and/or rough bottom, the haul was cut short or the net hung up.

untrawlable stations: stations determined to be untrawlable, because of steep topography and /or rough bottom, based either on fathometer recordings (ie., no haul was made), or on hauls where the net hung up and severely ripped.

Table 2.--Summary of hauls completed during Miller Freeman Cruise 90-08, 1990 triennial trawl survey in the eastern Gulf of Alaska.

Depth stratum (m)	Subarea name	Number of hauls: total	successful	unsuccessful
	Triennial Survey			
	Yakutat[a] Area:			
0-100	Yakutat Shallows	9	7	2
101-200	Yakataga Shelf	9	9	0
101-200	Yakutat Flats	15	14	1
101-200	Fairweather Shelf	13	13	0
201-300	Yakutat Gullies	25	25	0
201-300	Yakutat Slope	10	9	1
301-500	Yakutat Deep Gullies	12	12	0
301-500	Yakutat Slope	11	9	2
	Total, Yakutat	104	98	6
	Southeastern[b] Area:			
101-200	Baranof-Chichagof Shelf	12	10	2
101-200	Prince of Wales Shelf	16	13	3
201-300	Baranof-Chichagof Slope	9	9	0
201-300	Prince of Wales Slope and Gullies	19	18	1
301-500	Southeastern Deep Gullies	18	16	2
301-500	Southeastern Slope	3	2	1
	Total, Southeastern	77	68	9
	Rockfish Study Areas			
Yakutat Valley		13	12	1
Cape Ommaney		12	12	0
Grand Total for cruise		203	187	16

[a]Yakutat INPFC area east of 144°30' longitude.

[b]Southeastern INPFC area.

Note: For the total and successful categories of hauls, the number of survey hauls plus the number of rockfish study area hauls is greater than the grand total of hauls listed above. This is because three survey hauls located inside the rockfish study areas were also counted as study area hauls.

Table 3.--Number of fish measured for length frequency distributions, by species, during Miller Freeman Cruise 90-08, 1990 triennial trawl survey in the eastern Gulf of Alaska. (Includes data from successful survey hauls only.)

Species	Yakutat[a]	Southeastern[b]	Total
Pacific sleeper shark	1	0	1
Arrowtooth flounder	3,027	1,800	4,827
Pacific halibut	112	54	166
Flathead sole	692	0	692
Petrale sole	0	12	12
English sole	44	0	44
Dover sole	1,096	644	1,740
Rex sole	812	1,170	1,982
Butter sole	88	0	88
Sablefish	520	462	982
Pacific cod	0	362	362
Walleye pollock	2,872	1,129	4,001
Eulachon	65	0	65
Shortspine thornyhead	1,999	2,984	4,983
Rougheye rockfish	577	148	725
Pacific ocean perch	2,528	3,726	6,254
Dusky rockfish	80	0	80
Silvergrey rockfish	0	247	247
Redstripe rockfish	0	677	677
Redbanded rockfish	29	25	54
Harlequin rockfish	177	456	633
Sharpchin rockfish	576	2,154	2,730
Shortraker rockfish	220	56	276
Yellowmouth rockfish	0	52	52
Total	15,515	16,158	31,673

[a]Yakutat INPFC area east of 144°30' longitude.

[b]Southeastern INPFC area.

Table 4.--Number of fish sampled for otoliths during Miller Freeman Cruise 90-08, 1990 triennial trawl survey in the eastern Gulf of Alaska.

Species	Number of fish sampled		
	Yakutat[a]	Southeastern[b]	Total
Arrowtooth flounder	173	121	294
Pacific halibut	122	58	180
Rex sole	87	63	150
Juvenile sablefish	71	0	71
Rougheye rockfish	341	72	413
Pacific ocean perch	490	397	887
Redstripe rockfish	0	35	35
Sharpchin rockfish	0	39	39
Shortraker rockfish	198	57	255
Total	1,482	842	2,324

[a]Yakutat INPFC area east of 144°30' longitude.

[b]Southeastern INPFC area.

Table 5.--Major species caught in the Yakutat area[a] during Miller Freeman Cruise 90-08, 1990 triennial trawl survey in the eastern Gulf of Alaska. (Includes data from successful survey hauls only.)

Rank	Species	Mean CPUE[b] (kg/hr)
1	Pacific ocean perch	217.7
2	Arrowtooth flounder	116.6
3	Walleye pollock	62.7
4	Jellyfish unident.	46.5
5	Sablefish	43.9
6	Dover sole	35.2
7	Shortraker rockfish	28.3
8	Rougheye rockfish	21.0
9	Shortspine thornyhead	18.7
10	Pacific halibut	16.8
11	Flathead sole	15.2
12	Rex sole	10.8
13	Sharpchin rockfish	9.6
14	Skates	9.2
15	Eulachon	9.1
16	Pacific cod	8.7
17	Sponge unident.	7.1
18	Lingcod	6.1
19	Dusky rockfish	3.0
20	Redbanded rockfish	3.0
21	Giant grenadier	2.5
22	Red squid	2.2
23	Sea urchin unident.	2.2
24	English sole	2.1
25	Heart urchin	1.7
26	Spiny dogfish	1.5
27	Chum salmon	1.4
28	Pacific sleeper shark	1.3
29	Sidestripe shrimp	1.2
30	Harlequin rockfish	0.9
	Other species	10.6
	Total	716.9

[a]Yakutat INPFC area east of 144°30' longitude.

[b]Catch per unit effort, regardless of depth = (total weight for all successful hauls combined) / (total hours of trawl effort).

Table 6.--Major species caught in the Southeastern area[a] during Miller Freeman Cruise 90-08, 1990 triennial trawl survey in the eastern Gulf of Alaska. (Includes data from successful survey hauls only.)

Rank	Species	Mean CPUE[b] (kg/hr)
1	Pacific ocean perch	298.2
2	Sharpchin rockfish	192.5
3	Arrowtooth flounder	166.2
4	Redstripe rockfish	71.5
5	Walleye pollock	69.9
6	Sablefish	60.2
7	Shortspine thornyhead	52.2
8	Pacific cod	42.4
9	Silvergrey rockfish	39.5
10	Dover sole	35.0
11	Alaska coral	29.1
12	Pacific halibut	19.8
13	Rex sole	18.6
14	Jellyfish unident.	14.3
15	Yellowmouth rockfish	14.2
16	Lingcod	11.3
17	Harlequin rockfish	10.7
18	Rougheye rockfish	9.8
19	Shortraker rockfish	9.3
20	Eulachon	9.2
21	Sponge unident.	8.6
22	Redbanded rockfish	7.8
23	Spotted ratfish	6.1
24	Rosethorn rockfish	3.6
25	Red squid	3.5
26	Heart urchin	3.3
27	Dusky rockfish	3.2
28	Skates	3.0
29	Giant grenadier	2.7
30	Spiny dogfish	2.3
	Other species	19.8
	Total	1,237.8

[a]Southeastern INPFC area.

[b]Catch per unit effort, regardless of depth = (total weight for all successful hauls combined) / (total hours of trawl effort).

Table 7.--Catch rates of major rockfish species at the two rockfish study areas sampled during Miller Freeman Cruise 90-08.

Haul No.	Depth (m)	Catch of rockfish in kg/hr POP[a]	Dusky	Red-stripe	Harle-quin	Sharp-chin
		Yakutat Valley Rockfish Study Area:				
143	218	6,069.0	24.5	0.0	0.0	0.0
144	196	77.1	804.8	0.0	118.0	152.8
145	194	3.5	0.0	0.0	0.0	0.5
146	198	2.7	0.0	0.0	0.0	0.0
147	203	16.6	455.9	0.0	21.8	10.9
148	214	479.3	9.5	0.0	16.3	142.1
149	208	19.6	10.1	0.0	0.0	6.3
150	201	3.0	639.6	0.0	227.2	1,150.4
151	205	0.0	1,142.2	137.4	259.4	529.3
152	207	815.4	4,295.7	710.3	248.7	200.8
153	214	24.0	0.0	0.0	0.0	0.0
154	218	0.0	0.0	0.0	0.0	0.0
155	210	30.3	0.0	0.0	0.0	9.4
mean		580.1	567.9	65.1	68.5	169.4
		Cape Ommaney Rockfish Study Area:				
33	187	134.7	0.0	0.8	13.6	57.2
34	187	2,215.3	0.0	0.0	10.9	59.9
35	187	333.4	0.0	0.0	46.3	89.8
36	194	788.7	0.0	0.0	4.1	68.0
37	194	330.7	0.0	0.0	65.3	383.7
38	190	110.2	0.0	0.0	46.3	189.1
39	207	1,188.0	0.0	0.0	0.0	141.5
40	205	847.6	0.0	2.5	3.7	41.4
41	203	570.2	0.0	0.0	0.0	5.4
42	214	570.2	0.0	0.0	0.0	1.4
43	216	941.7	0.0	2.2	0.5	19.1
44	227	1,868.3	0.0	0.0	0.0	15.0
mean		824.9	0.0	0.4	15.0	89.2

[a]Pacific ocean perch

Table 8.--Biomass estimates and associated 95% confidence intervals (C.I.) for major rockfish species at the Yakutat Valley and Cape Ommaney rockfish study sites sampled during Miller Freeman Cruise 90-08.

Species	Yakutat Site biomass (mt)	Yakutat Site 95% C.I.	Ommaney Site biomass (mt)	Ommaney Site 95% C.I.
Pacific ocean perch	552	±177%	597	±57%
Dusky rockfish	556	±136%	0	-
Redstripe rockfish	70	±180%	0	-
Harlequin rockfish	64	±102%	13	±92%
Sharpchin rockfish	145	±112%	71	±85%

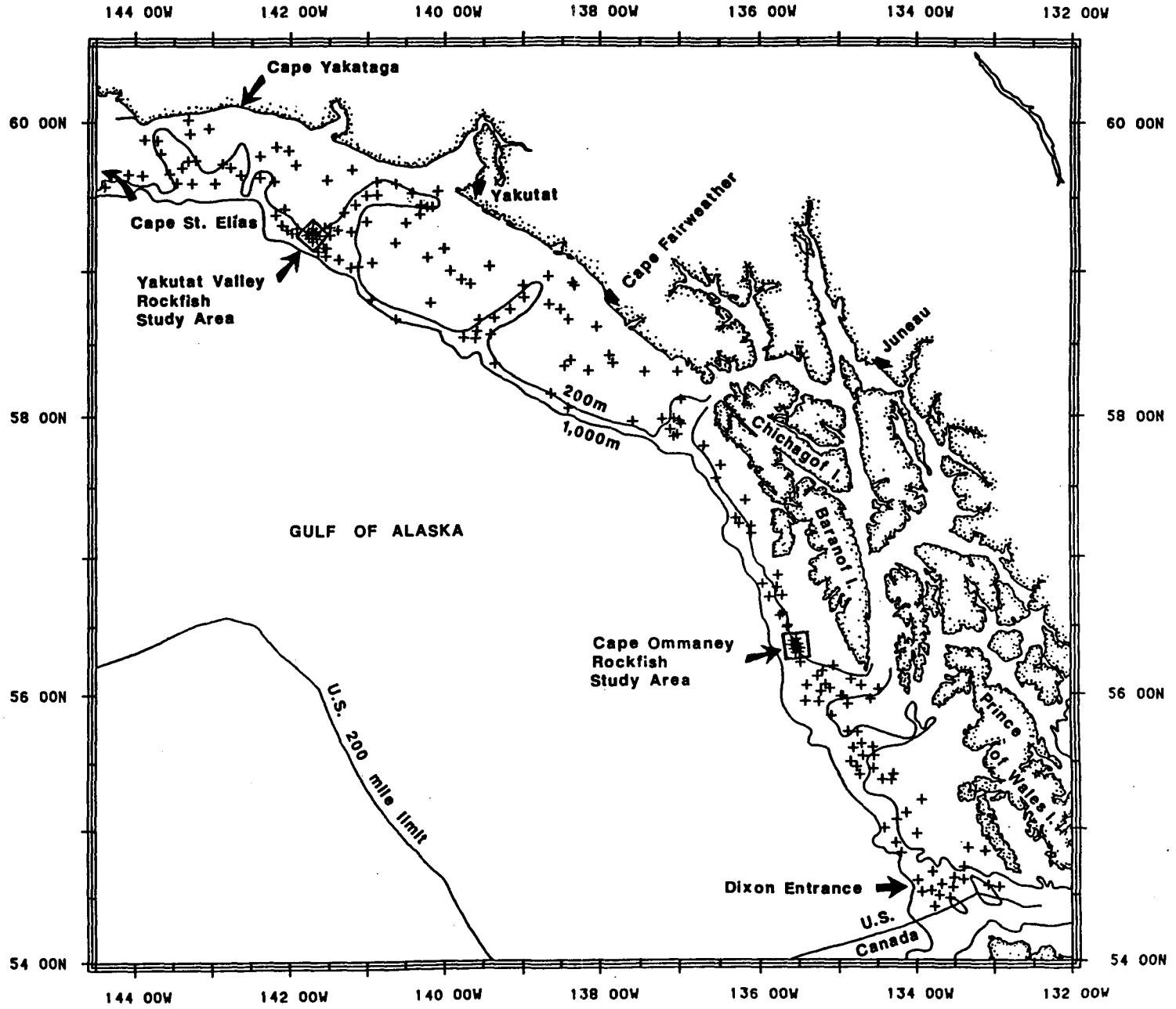

Figure 1. Location of trawl hauls made during Miller Freeman Cruise 90-08, 1990 triennial trawl survey in the eastern Gulf of Alaska.